

Science & the Delta Visioning Process

A Report of the CALFED Science Program's Delta Science Panel

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The Delta Science Panel's Charge:

“Prepare a report, based on a synthesis of CALFED science, that will be used to inform the development of scenarios or options for a new long-term Delta vision.”

Problems Facing the Delta Visioning Process:

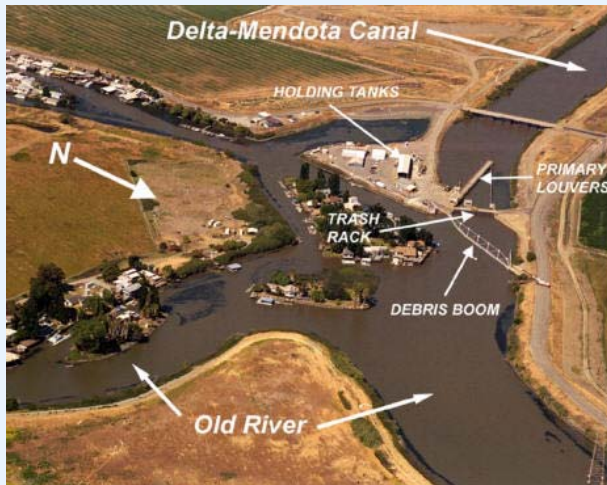


- **The Delta is a dynamic landscape and ecosystem undergoing significant change at multiple scales**
- **Change, both gradual and abrupt, will impact management of the Delta and environmental services**
- **Future “preferred states” of the Delta must accommodate hydrologic, ecologic and physical landscape change**

“Environmental Services” Provided by the Delta and Impacted by Change

- Farming
- Water Supply/Quality
- Flood Control
- Agricultural runoff disposal
- Urban runoff disposal
- Powerplant disposal
- Shipping
- Transportation
- Ecosystem services
- Fishing
- Hunting
- Boating
-
- *Urban development?*

Guide and Test Delta Options through Filtering



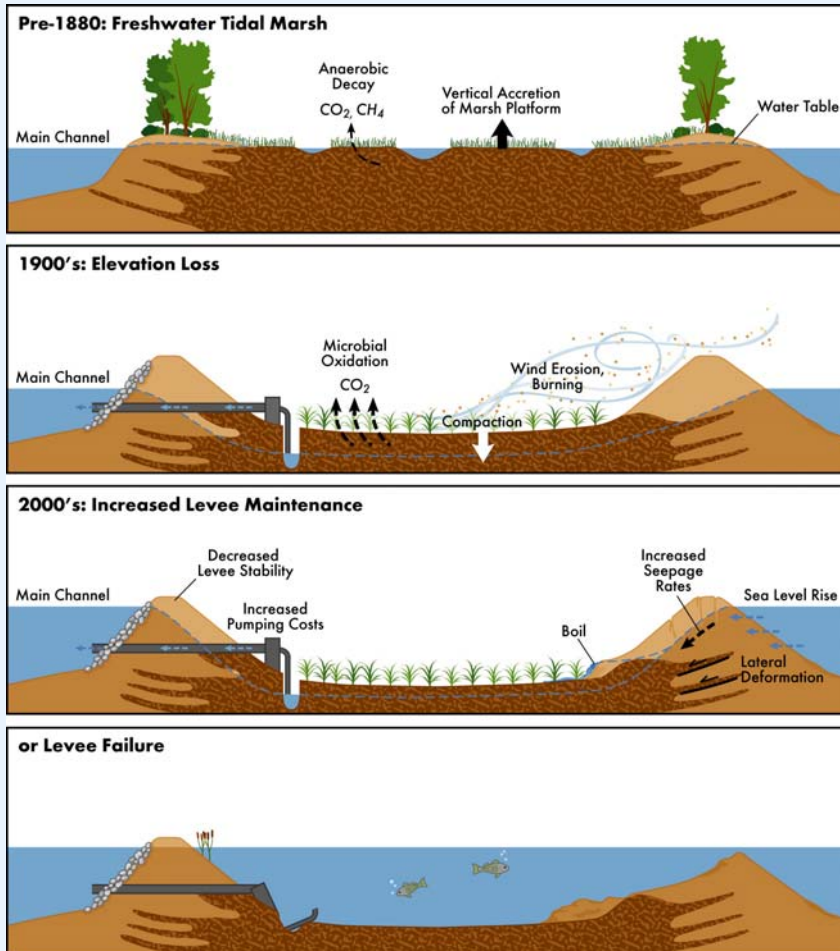
- Dynamic, not static conditions in the Delta
- Endogenous and exogenous forces acting on the Delta at landscape scale
- Forces provide useful first-order “filter” of potential Delta solutions and help reduce the proliferation of “what ifs”

Guide and Test Delta Options: Six First-Order Filters



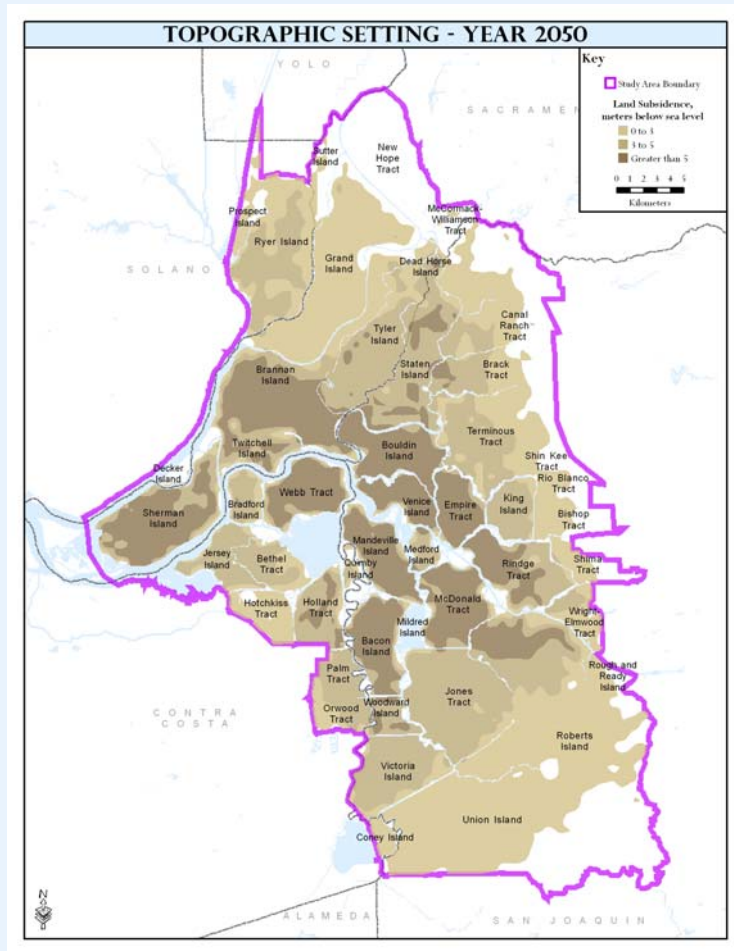
- Subsidence
- Sea Level Rise
- Regional Climate Change
- Seismicity
- Exotics and Ecosystem Change
- Population Growth & Urbanization

Filter 1: Subsidence



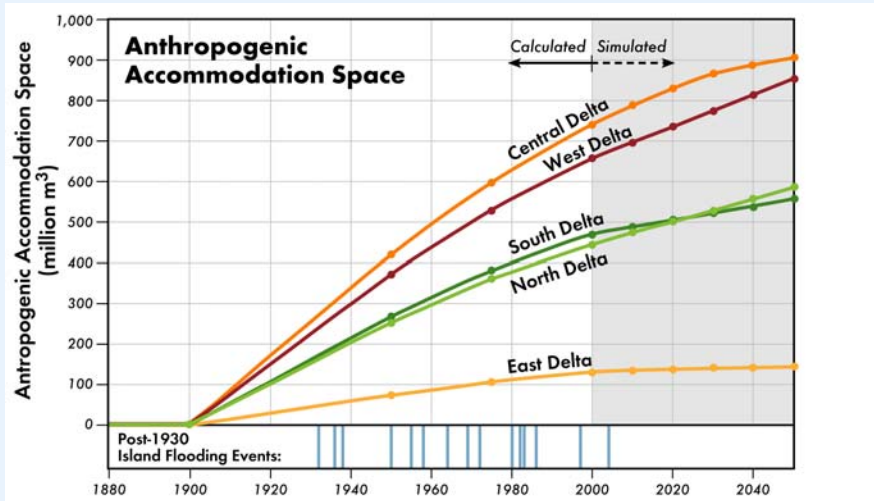
- Reclamation the greatest influence on the Delta
- Subsidence and associated levee construction an important legacy effect
- Subsidence will continue into the future

Filter 1: Subsidence

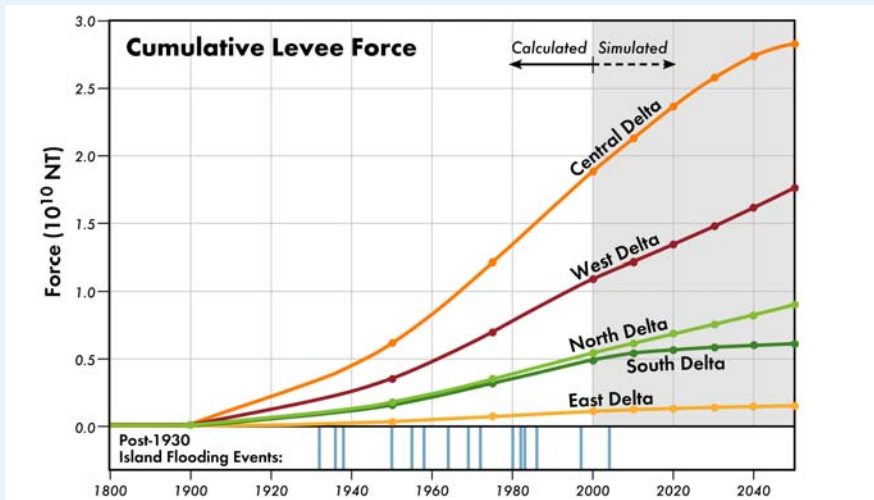


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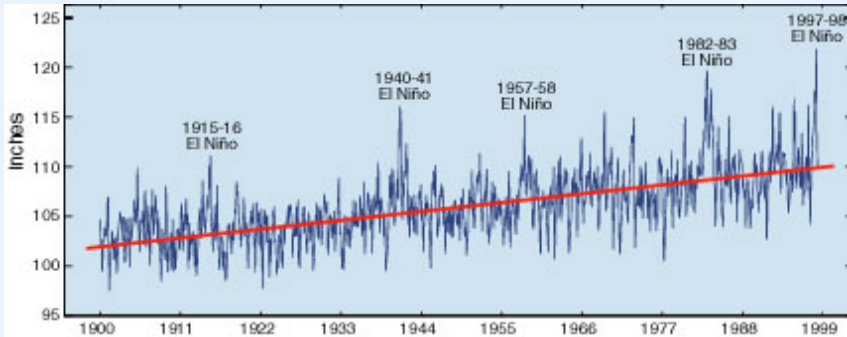
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Filter 2: Sea Level Rise

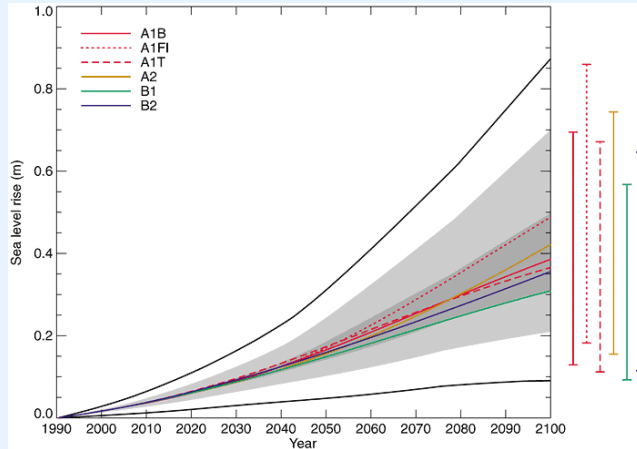


Ryan et al., 2005



- Character of Delta based on sea level
- All hydrodynamics, habitat conditions, levee heights tied to sea level
- Rate of sea level rise increasing
- A modest rise overwhelms current Delta levee network

Filter 2: Sea Level Rise



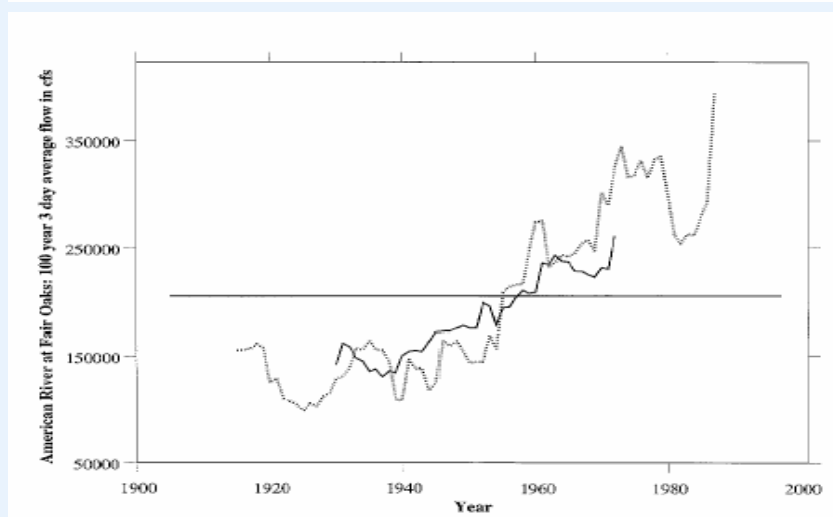
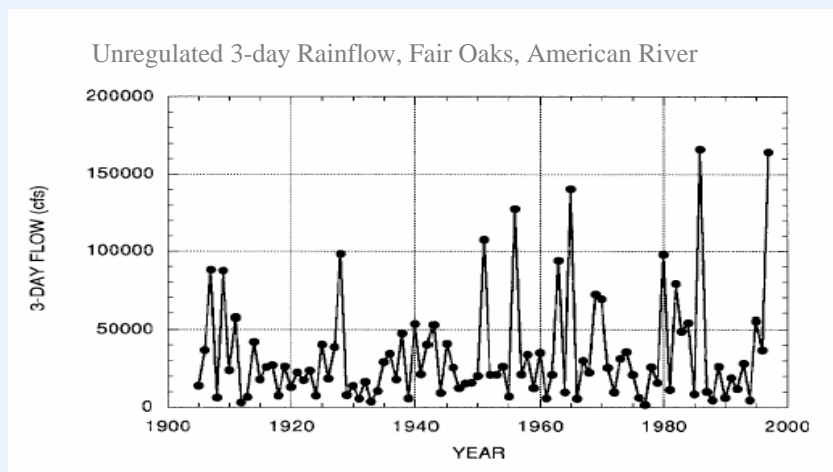
IPCC, 2001



Source: Anderson et al., 2001

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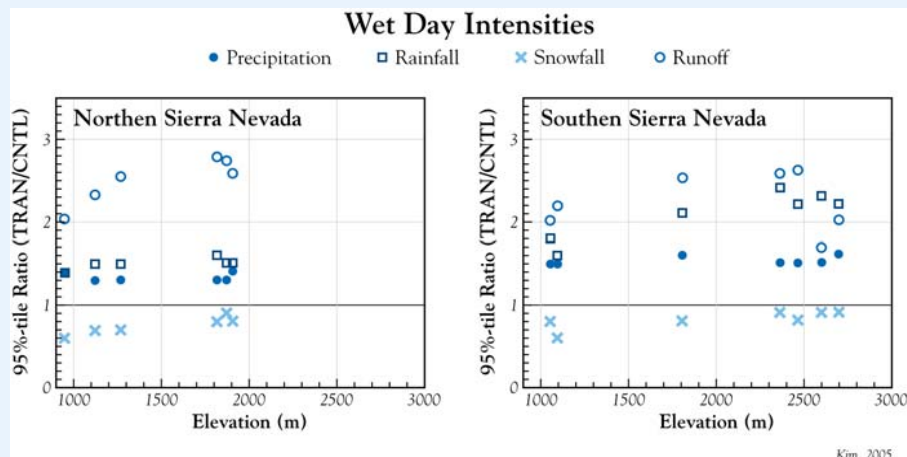
Filter 3: Changes in Runoff Conditions: High Flows*



- Timing of peak runoff shifting to winter
- Intensity of winter storm events appears to be increasing
- Downscaled models suggest continued increase in intensity and frequency of high runoff events

*modulated by water operations

Filter 3: Changes in Runoff Conditions: High Flows*

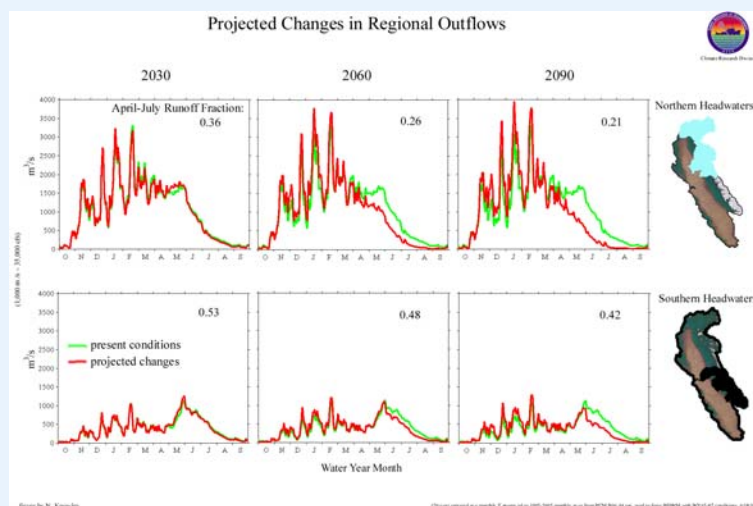
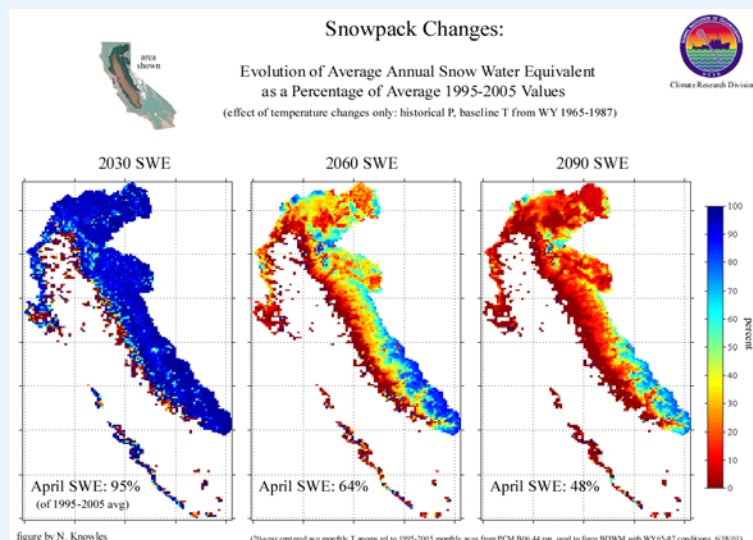


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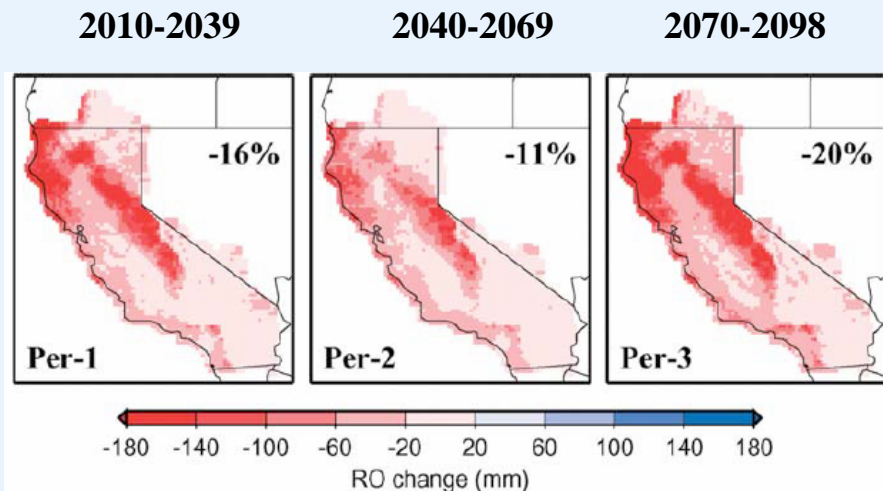
Filter 3: Changes in Runoff Conditions: Low Flows*



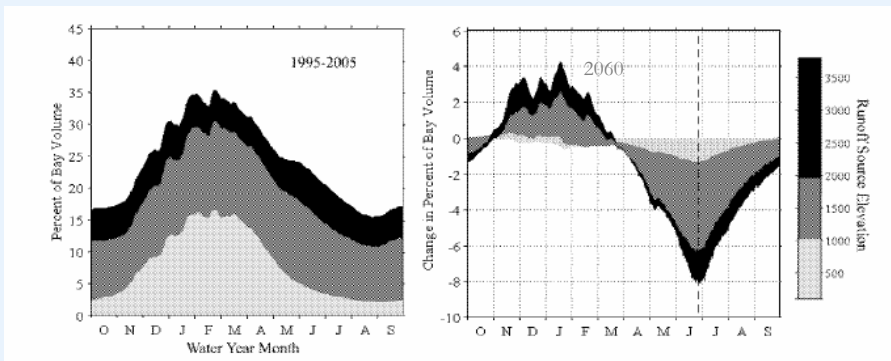
- Decline in spring flows extends low-flow periods
- Potential for increase in number of days failing to meet current environmental flow standards
- Significant decline in Delta water quality (relative to current standards) during low flow events

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VanRheenan et al., 2004



Knowles and Cayan, 2004

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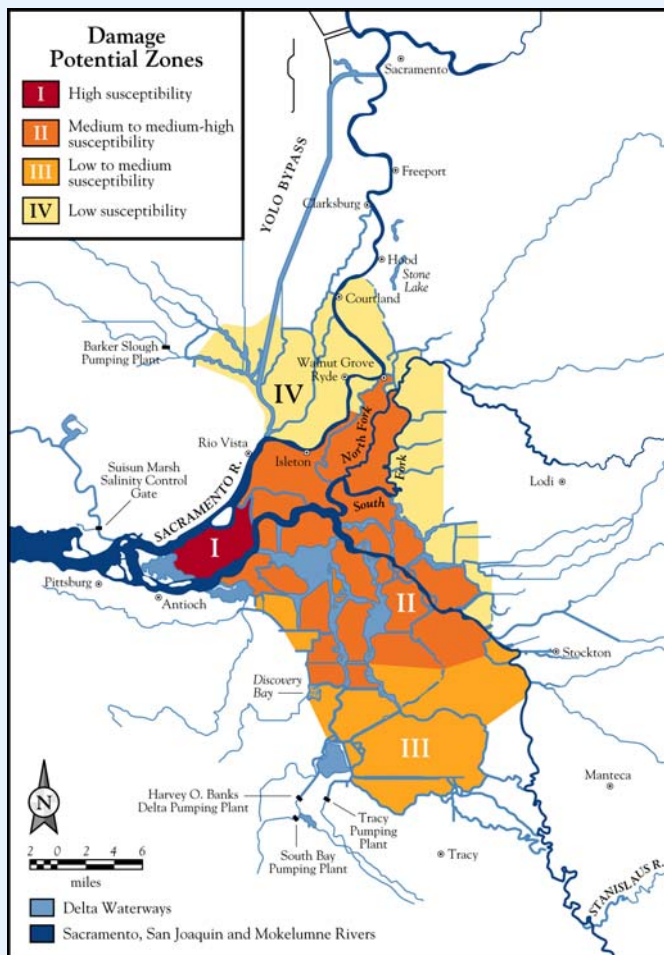
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Filter 4: Seismicity



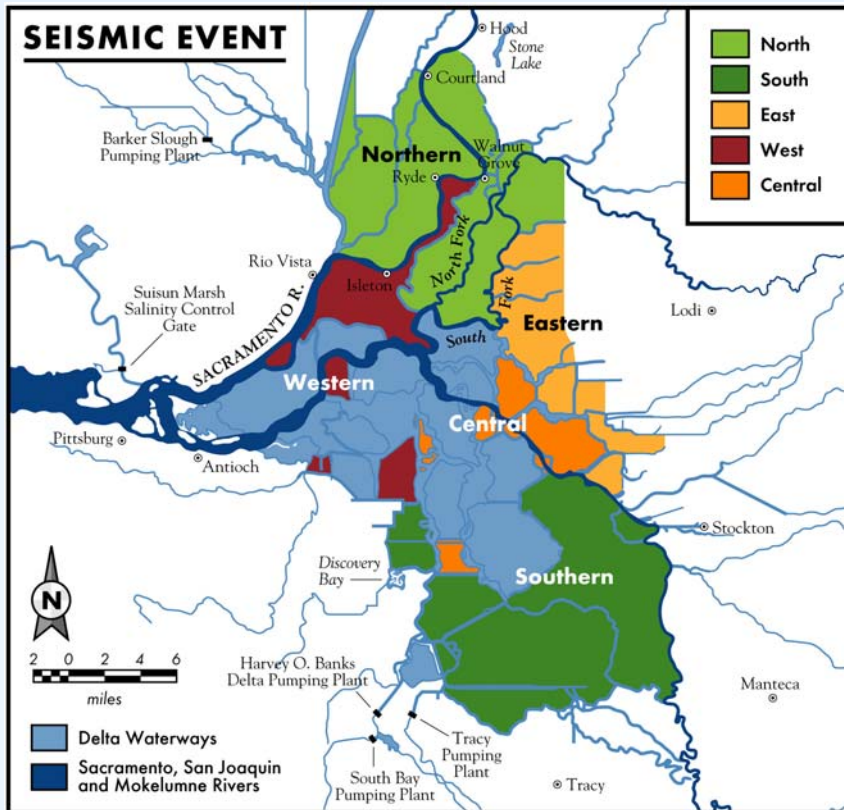
- Risk of levee failure significant at any time scale
- Risk highest in western Delta
- Unlike flood risk, seismic risk increases with time

Filter 4: Seismicity



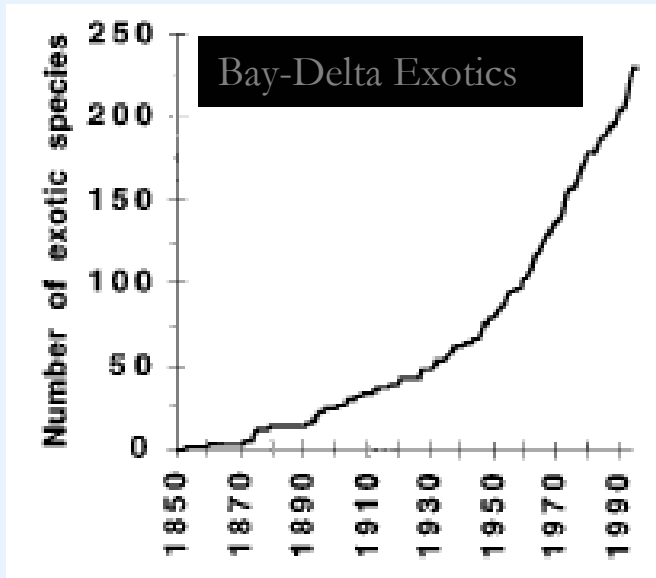
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Filter 5: Invasive Species and Ecosystem Change

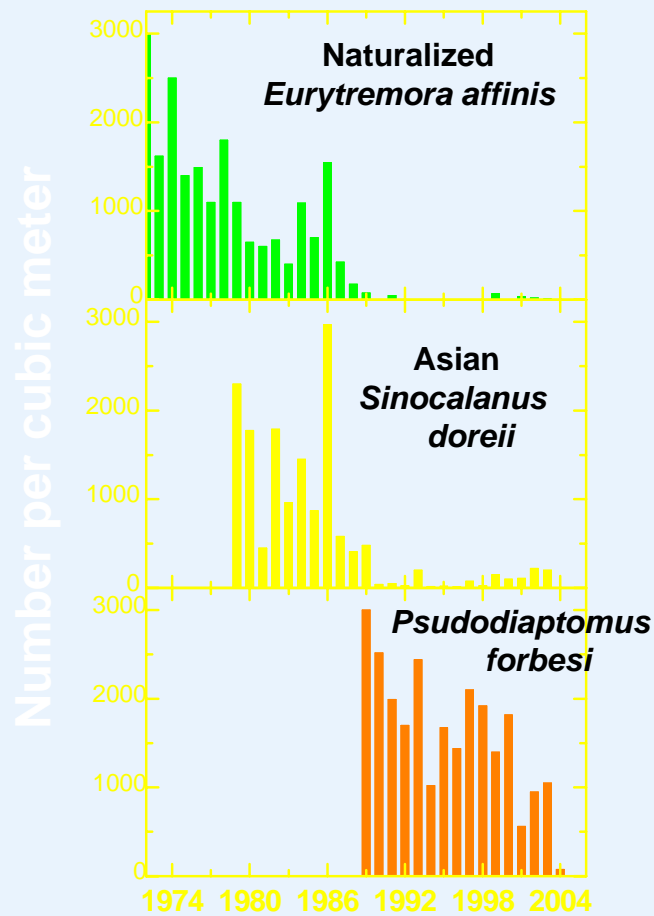


From Cohen and Carlton, 1998



- Bay-Delta may be the most invaded estuary in the world
- Pace of invasions may be accelerating
- Characteristics of the estuary appear ideal for future invasions from food web disruptors and ecosystem engineers
- Ecosystems will be different and respond in unpredictable ways to future management efforts

Filter 5: Invasive Species and Ecosystem Change



California Department of
Fish & Game Zooplankton
survey

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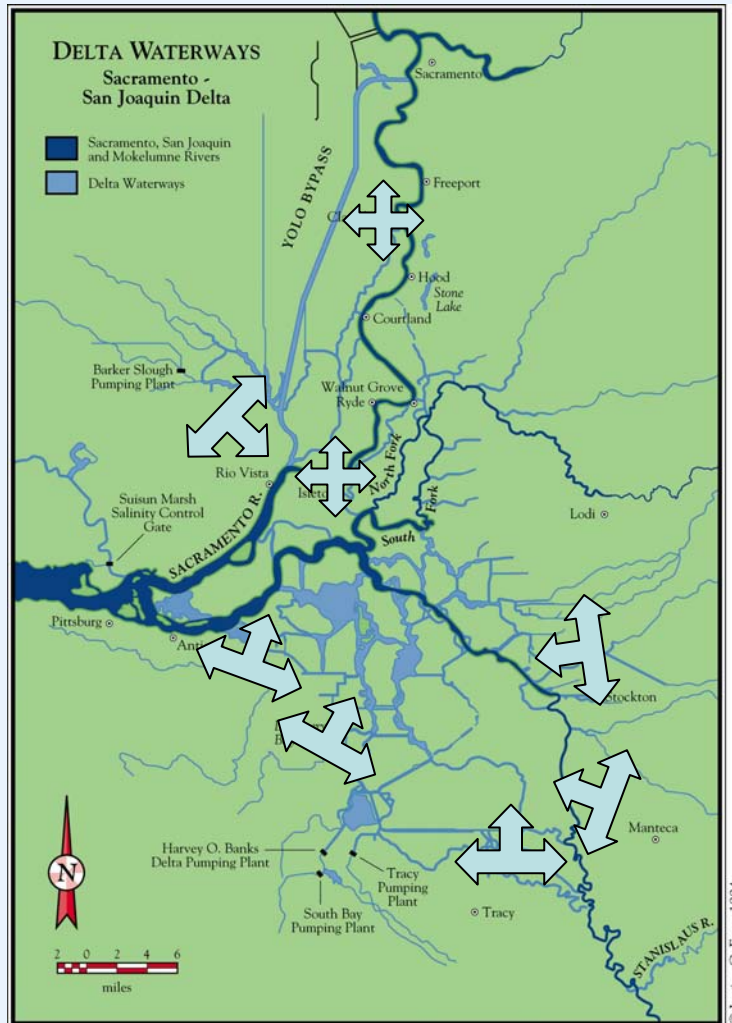
Filter 6: Population Growth & urbanization



- Fastest growing region in California
- Increasing population and water supply pressures
- Demand for conversion of the Delta to homes



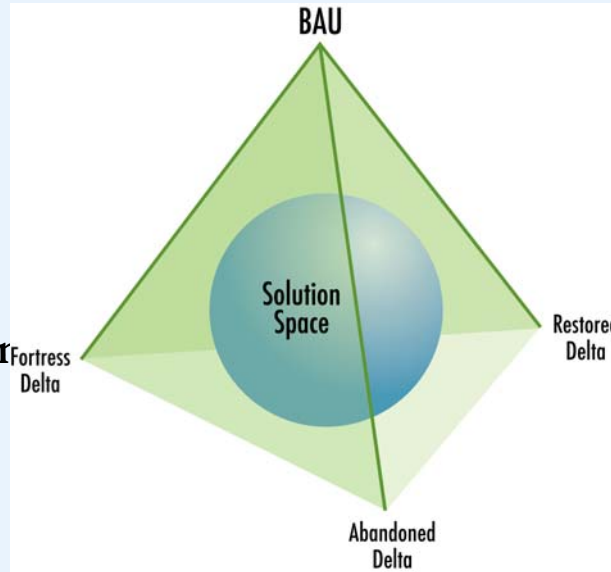
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Triangulating a Delta Solution

- Subsidence
- Sea Level Rise
- Seismicity
- Runoff Change
- Invasive Species
- Urbanization/Population



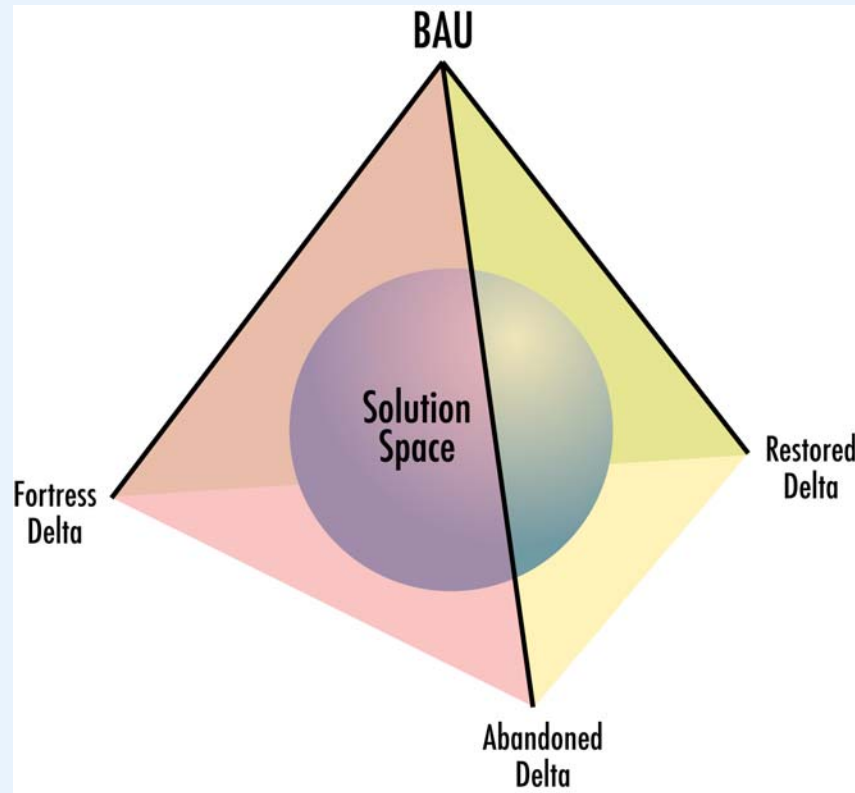
- Water Supply
- Farming
- Native Biodiversity
- Transportation
- Recreation
- Runoff Disposal



BAU

Business as Usual: Continued incremental management upgrade & maintenance;

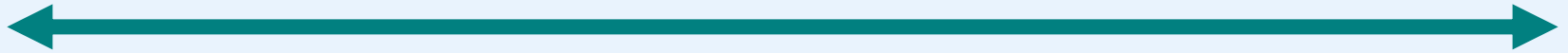
Fortress Delta:
Massive investment to resist forces of change:
The Netherlands model.



Restored Delta:
Ecosystem Management Primacy;
Mimic or accommodate forces of change

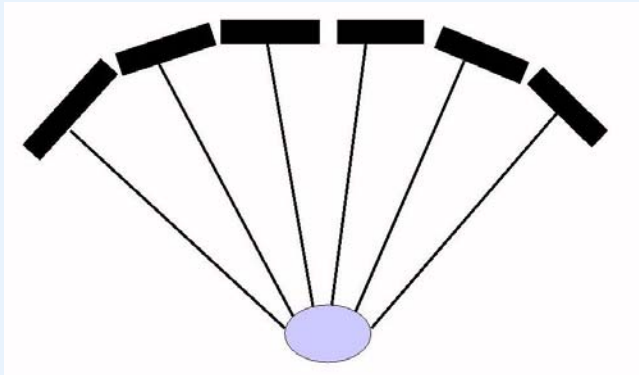
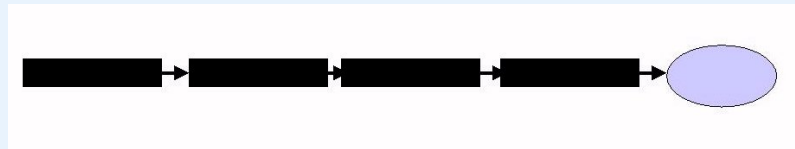
Abandoned Delta
Not likely by choice, but rational policies overtaken by the pace of change

Potential architectural models of the vision process:

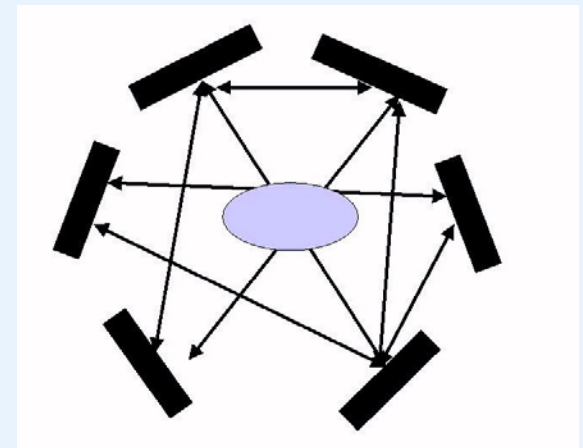


paralyzed | overly-cautious | deliberate, rational | bold | cavalier | blind

Freight train



Parachute



Wheel

The Role of Science in the anticipated Delta Vision Process: Potential Criteria for the evaluation of ideas, plans, & scenarios:

Criteria such as these below may trigger the need for scientific and technical support.

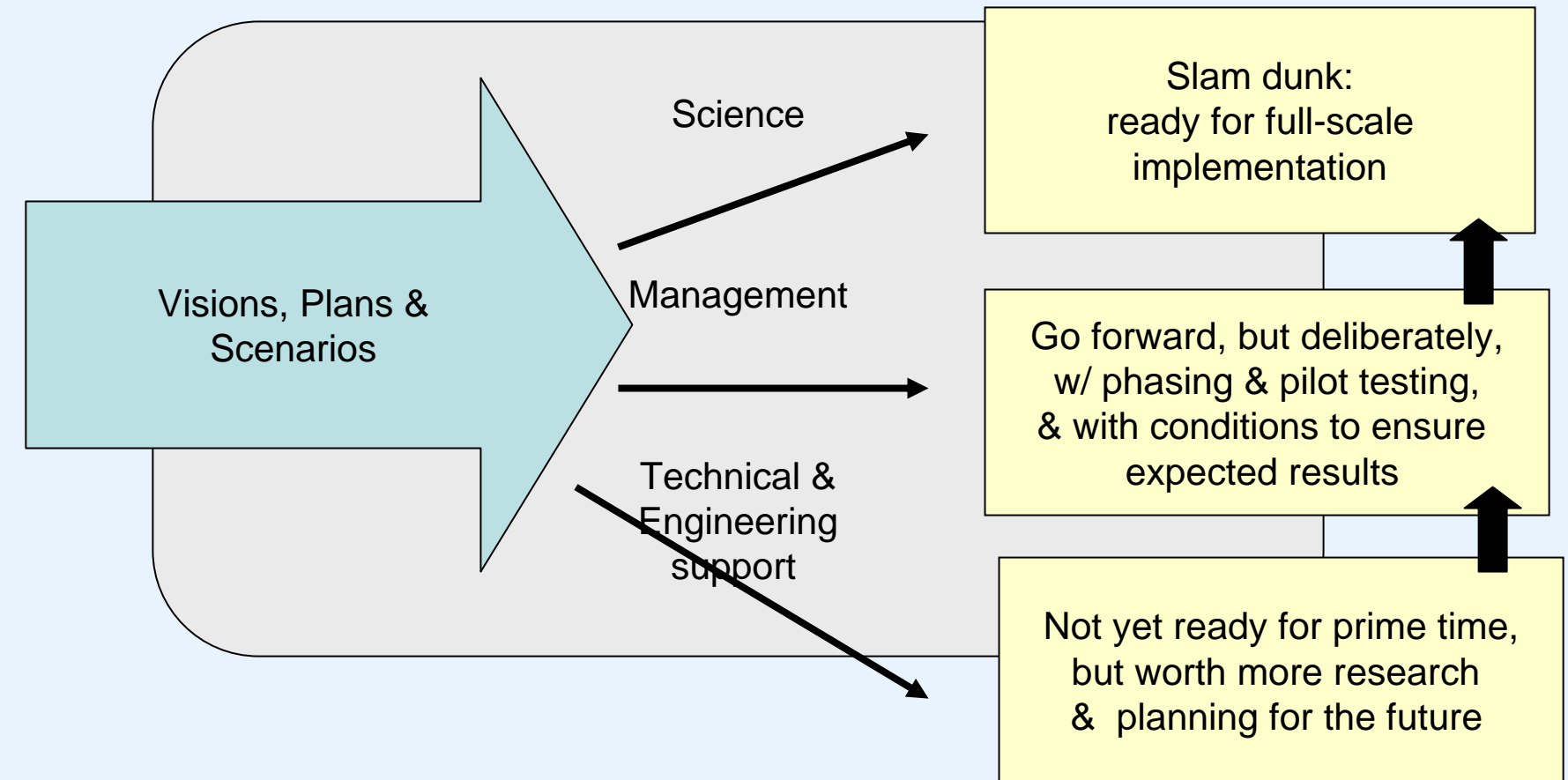
- **Robustness.** How will the proposal fare in the face of change? Could alternative technology, scale, timing, or location make the idea more feasible? Will it work some places in the Delta and not others?
- **Benefits/costs/equity.** What will it take, & at what cost? What do we gain? Who benefits & who pays? Secondary effects are important but hard to measure
- **Feasibility.** Will it work? Are assumptions about technology, costs and management solutions supported? Are proponents too optimistic? Opponents too pessimistic? Independent commentary can be helpful.

- **Expediency.** Can the proposal be implemented before options are foreclosed or the system is overwhelmed by exogenous forces of change?
- **Reversibility, Adaptability.** If it turns out not as planned, can it be undone or altered? Can it be phased, and then expanded after proof of concept? Can adaptive management principles be applied?
- **Containment.** Does it have spillover effects? What are those impacts, and can they be mitigated or used to advantage? Does it require close coordination with other proposals? This can be a good thing, if integrated comprehensive planning and management are assured.

Note: These criteria came from public work sessions of the CALFED Ecosystem Restoration Program's former Interim Science Board

Adaptive Management. Given the pace of change, a bold vision process may be looking for slam dunks. There may well be impatience with calls for caution and study. But remember the Healey Diagram*?

Given criteria such as those just mentioned, visions should be given a preliminary vetting:



* Michael Healey, Strategic Plan for Ecosystem Restoration, 1998

Forecasting urbanization in the Delta and periphery:

Should urbanization be treated as manageable?

Or as an uncontrolled force?

Traditional factors for forecasting the rate and location of urbanization:

- Specific location & housing market
- Proximity to infrastructure
- **Site development costs** (slope, flood-proofing, constraints)
- Proximity to schools, commerce, jobs, & urban services
- Land prices
- **Permits**
- etc.

Today:

- Regional location & housing market
- **Permits**
- Land prices
- Proximity to highways
- **Site development costs**
- Proximity to urban services
- etc.

Should the vision process (and science advisors) make the following assumptions about urbanization?

- Entire periphery, all private lands above 5' contour urbanized (most of these lowlands are outside the Delta Protection Commission's Primary Zone)
- Flood plains: +5' to +20' urbanized; No new bypasses?
- Deep Delta:
 - Bethel Island: major new urbanization
 - Andrus Island / Isleton: urbanized?
 - Others?
- Alternatives:
 - Add an urban version to the Fortress Delta concept?

Upshot: Treat urban growth in the Delta as a wildcard, perhaps outranking natural and purely exogenous forces.

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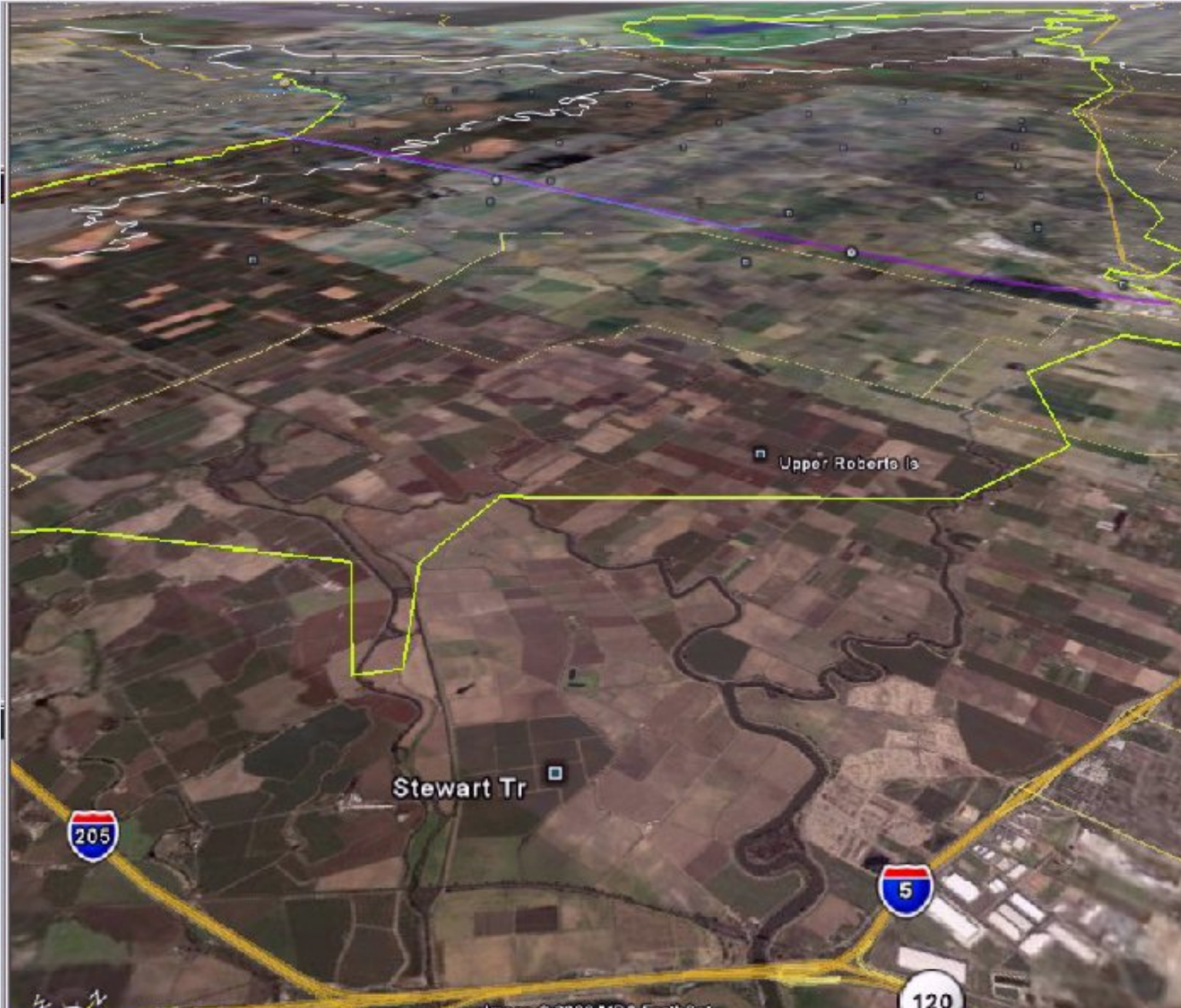
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Switch to GoogleEarth

Switch to GoogleEarth overflight.

The following slides can be used if the overflight is cancelled due to technical difficulties.



Stewart Tract: note meander channels of the San Joaquin River Floodplain

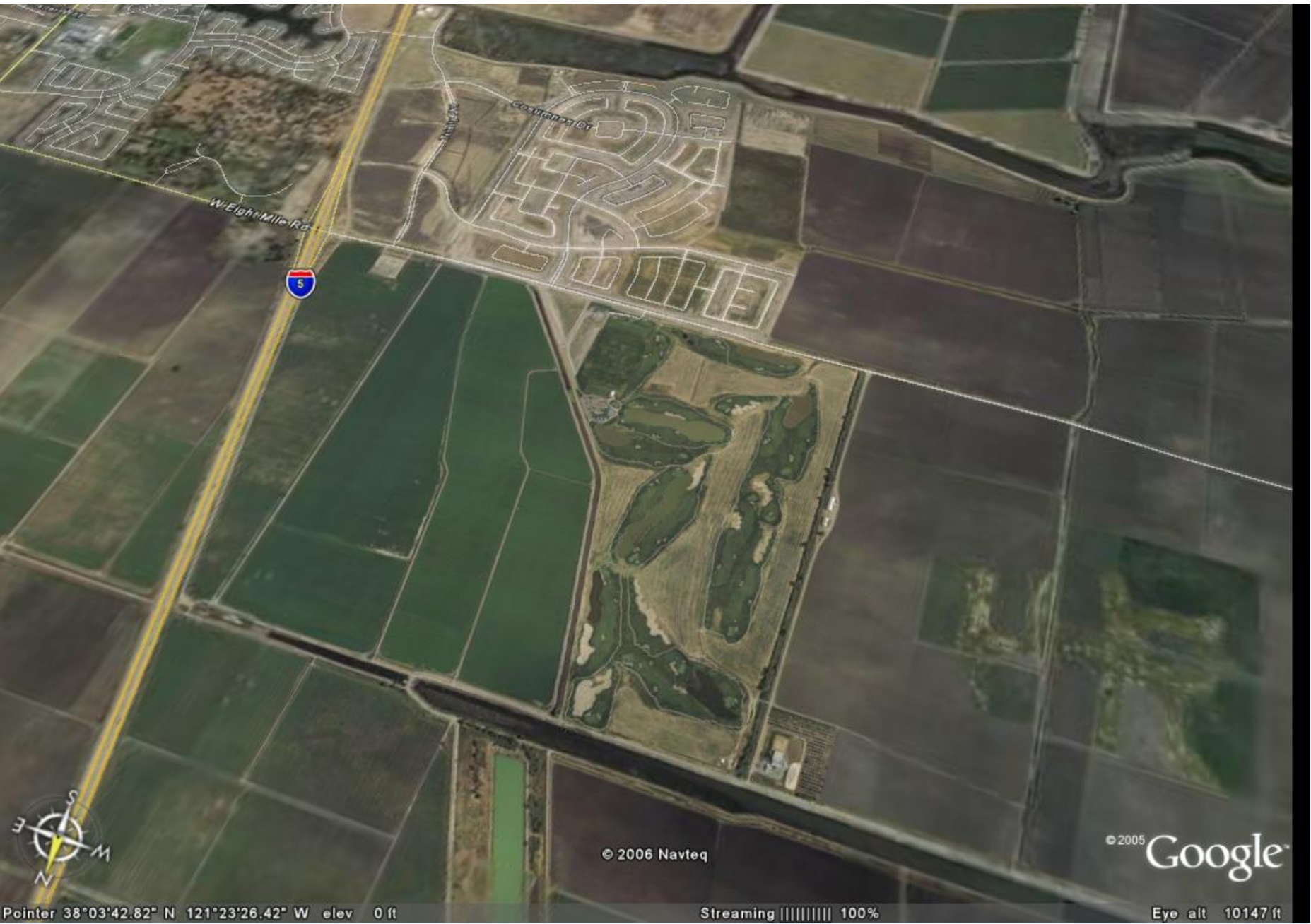


River Islands Development Plan, Stewart Tract, astride the floodplain



Levee construction, Stewart Tract, May 22, 2006

Urbanization in the path of the old Peripheral Canal Right of Way (green borrow pit at bottom), showing how options are being foreclosed.



Pointer 38°03'42.82" N 121°23'26.42" W elev 0 ft

Streaming ||||| 100%

Eye alt 10147 ft

The Sacramento/San Joaquin Delta: a moving target.

Robert Twiss

Prepared as part of the CALFED Science Program's Delta Vision Panel

Reference documents:

Delta Science Panel Report to the CALFED Science Program,
J. Mount, R. Adams, R. Twiss, June, 2006.

“Subsidence, sea level rise, and seismicity in the Sacramento-San Joaquin Delta”
San Francisco Estuary & Watershed Science, Volume 3, Issue 1, March, 2005.

J. Mount, R. Twiss

(On line at: <http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art5/>)

